IN THE CLAIMS

Claim 1 (original): A laser ionization mass spectrometer comprising pulsed gas ejecting means, a laser beam irradiation system, repeller and extraction electrodes and mass analyzing means characterized in
that said pulsed gas ejecting means is provided with a valve for ejecting carrier gas containing sample molecules into a vacuum chamber in pulse mode,
that said laser beam irradiation system irradiates laser beam to said carrier gas ejected into said vacuum chamber for selective photo reaction of said sample molecules in said carrier gas ejected into said vacuum chamber,
that said repeller and extraction electrodes are arranged within said vacuum chamber and generate an electric field for extracting sample molecules formed by said photo reaction,
that said mass analyzing means analyzes mass of sample molecular ions extracted by said repeller and extraction electrodes,
that a valve of said pulsed gas ejecting means is set so that said pulsed gas has pulse length shorter than a distance from an ejecting position to said laser beam irradiation point to said carrier gas and
that said laser beam irradiation system is set so as to irradiate laser beam to said carrier gas near a position whereat a leading portion gas of said pulsed gas translating in said vacuum chamber, i.e. a gas ejected before full opening of said valve, is overtaken by a faster flat portion gas, i.e. a gas ejected during full open of said valve.

Claim 2 (currently amended): ~~A~~ The mass spectrometer as claimed in claim 1
characterized in
that a laser beam irradiation positioning means is further provided

for determination of laser beam irradiation position to said carrier gas flow by said laser beam irradiation system before analysis of said carrier gas containing said sample molecules,
that said laser beam irradiation positioning means is provided with a high speed ionization vacuum gauge removably arranged at a crossing point of a carrier gas flow ejected from said pulsed gas ejecting means into said vacuum vessel and laser beam irradiated from said laser beam irradiation system and an oscilloscope for indicating a pressure time waveform of said carrier gas flow detected by said high speed ionization vacuum gauge,
that said pulsed gas ejecting means is formed able to change its distance from said high speed ionization vacuum gauge arranged within said vacuum vessel and
that a position whereat said pressure time waveform transitions from a flat-top trapezoidal pressure distribution with a flat portion to a triangular pressure distribution without said flat portion can be confirmed by oscilloscope observation of change in pressure time waveform of said carrier gas flow following change in position of said pulsed gas ejecting means.

Claim 3 (original): A positioning method of laser beam irradiation to a carrier gas flow prior to mass analysis of sample molecular ions using a laser ionization mass spectrometer comprising a pulsed gas ejecting means, a laser beam irradiation system, repeller and extraction electrodes and mass analyzing means, said pulsed gas ejecting means ejecting carrier gas containing sample molecules into a vacuum chamber in a pulse mode, said laser beam irradiation system irradiating laser beam to said carrier gas containing said sample molecules and ejected into said vacuum chamber for selective photo-reaction of sample molecules in said carrier gas, said repeller and extraction electrodes being arranged within said vacuum chamber for generation of an electric field for extraction of sample molecular ions generated by said photo reaction and said mass analyzing means analyzing mass of sample molecular ions

extracted by said repeller and extraction electrodes,
comprising the steps of
arranging said pulsed gas ejecting means at an initial position of said vacuum vessel,
arranging a high speed ionization vacuum gauge at a cross point of said carrier gas ejected from said pulsed gas ejecting means into said vacuum vessel with laser beam irradiated from said laser beam irradiation system,
ejecting in pulse mode said carrier gas flow from said pulsed gas ejecting means to said high speed ionization vacuum gauge at said initial position,
detecting pressure of said carrier gas flow by said high speed ionization vacuum gauge,
observing a pressure time waveform of said carrier gas by an oscilloscope,
confirming presence of a flat portion in said waveform,
moving stepwise said pulsed gas ejecting means from said initial position in a direction distant from said high speed ionization vacuum gauge,
ejecting in pulse mode said carrier gas flow from said pulsed gas ejecting means to said high speed ionization vacuum gauge at respective positions in movement,
detecting pressure of said carrier gas flow by said high speed ionization vacuum gauge,
observing pressure time waveform of said carrier gas by said oscilloscope,
confirming absence of said flat portion in said pressure time waveform of said carrier gas flow at any position observed by said oscilloscope and
setting laser beam irradiation point to said carrier gas flow near a relative position of said gas ejecting opening of said pulsed gas ejecting means to said high speed ionization vacuum gauge when said flat portion is not observed.

Claim 4 (currently amended): ~~A~~ The mass spectrometer as claimed in claim 1 ~~or 2~~ characterized in
that laser beam irradiation point (X) to said carrier gas flow is set to a range of $0.5X_L<X<1.5X_L$ wherein X_L is a distance of a position whereat said pressure time waveform transitions from said flat-top trapezoidal pressure distribution to said triangular pressure distribution from said gas ejecting opening of said pulsed gas ejecting means.

Claim 5 (currently amended): ~~A~~ The mass spectrometer as claimed in ~~any of claims 1, 2 and 4~~ claim 1 characterized in
that said pulsed gas ejecting means comprises a gas retention space connected to a supply source of carrier gas containing said sample molecules, a flange blocking between said gas retention space and said vacuum chamber, a nozzle, an elastic seal element and a valve body,
characterized in
that said nozzle is provided with a sheet surface supported by said flange and facing said gas retention space, an outer surface located on the opposite side of said sheet surface whilst facing said vacuum chamber and a ventilation passage extending through a gap between said sheet surface and said outer surface,
that said elastic sealing element is arranged on said sheet surface of said nozzle and
that said valve body is arranged within said gas retention space and displaceable between a closed position whereat said sheet surface is in contact with said sealing element for blocking said ventilation passage and an open position whereat said sheet surface leaves from said sealing element over a prescribed distance due to electro-magnetic driving for opening said ventilation passage of said nozzle and
that a distance between said valve body and said sealing element at said open position is 0.25 or more times larger than a diameter of said ventilation passage of said nozzle on said sheet surface.

Claim 6 (currently amended): ~~A~~ The mass spectrometer as claimed in claim 5 characterized in
that said pulsed gas ejecting means is provided with adjusting means for changing said distance between said elastic element and said sheet surface of said valve body in response to thermal expansion of said elastic sealing element for maintenance of a prescribed gap between said sheet surface at said opening position of said valve body and said elastic sealing element even during said thermal expansion of said elastic sealing element.

Claim 7 (currently amended): ~~A~~ The mass spectrometer as claimed in claim 6 characterized in
that said adjusting means for changing said distance between said elastic sealing element of said pulsed gas ejecting means and said sheet surface of said valve body is means for moving said nozzle supporting said elastic sealing element in an axial direction with respect to said flange.

Claim 8 (currently amended): ~~A~~ The mass spectrometer as claimed in claim 5 characterized in
that a diameter of said ventilation passage of said nozzle on said sheet surface is set to be 0.75 mm or larger.

Claim 9 (currently amended): ~~A~~ The mass spectrometer as claimed in claim 5 characterized in
that said ventilation passage of said nozzle is a divergent type ventilation passage which is constant in diameter in an area from said sheet surface to said outer surface and increases said diameter with a prescribed angle of divergence in an area from said prescribed position to said outer surface.

Claim 10 (currently amended): ~~A~~ The mass spectrometer as claimed in claim 9 characterized in

that said divergent type ventilation passage has a diameter of 0.75 mm or larger on said sheet surface.

Claim 11 (currently amended): ~~A~~ The mass spectrometer as claimed in claim 9 ~~or 10~~ characterized in
that said divergent type ventilation passage is constant in diameter in an area before a prescribed position of one third or shorter of a distance from said sheet surface to said outer surface and increases said diameter with an angle of divergence in a range from 4 to 20 degrees in an area from said prescribed position to said outer surface.

Claim 12 (currently amended): ~~A~~ The mass spectrometer as claimed in claim 5 characterized in
that said laser beam irradiation point to said pulsed gas flow is a point distant from said outer surface of said nozzle over a distance longer than a pulse full width half maximum length of said pulsed gas flow.

Claim 13 (currently amended): ~~A~~ The mass spectrometer as claimed in ~~any of claims 1, 2 and 4~~ claim 1 characterized in
that said repeller electrode is provided with a mesh able to pass said pulsed gas to said laser beam irradiation point and arranged between said pulsed gas ejecting means and said extraction electrode.

Claim 14 (currently amended): ~~A~~ The mass spectrometer as claimed in ~~any of claims 1, 2 and 4~~ claim 1 characterized in
that said laser beam irradiation system is provided with a pair of confronting mirror sets each made up of a plurality of concave mirrors and
that each said concave mirror is angled so as to form an aggregation region of laser fluxes at a laser beam irradiation point to said pulsed gas through sequential and reciprocal

reflection of laser beam between a pair of mirror sets.

Claim 15 (currently amended): ~~A~~ The mass spectrometer s claimed in ~~any of claims 1, 2 and 4~~ claim 1 characterized in
that said laser beam irradiation system is provided with first and second mirror sets each including a plurality of concave mirrors and laser beam guide means for inputting said laser beam into one of said first and second mirror sets and outputting said laser beam after prescribed times of reciprocal reflection between mirror sets,
that each said concave mirror pertaining to said first mirror set is arranged so as to reflect said laser beam toward one corresponding concave mirror in said second mirror set,
that each said concave mirror pertaining to said second mirror set is arranged so as to reflect laser beam incident from one corresponding mirror in said first mirror set to another concave mirror adjacent to said one concave mirror thereby moving said laser beam sequentially and continuously in a circumferential direction of said mirror set,
that a laser beam reflected by one of each said concave mirror pertaining to said first mirror set and each said concave mirror pertaining to said second mirror set is a convergent laser beam and a laser beam reflected by another of each said concave mirror pertaining to said first mirror set and each said concave mirror pertaining to said second mirror set is a parallel laser beam,
that a focal length of each said concave mirror is set so as to focus said parallel laser beam in a prescribed region between said two mirror sets and focus said convergent laser beam outside said prescribe region and
that said laser beam of said parallel beam focuses at said laser beam irradiation point to said pulsed gas and
that said prescribed region is formed wherein said laser beam of said convergent beam does not focus.

Claim 16 (currently amended): ~~A~~ The mass spectrometer as claimed in claim 14 ~~or 15~~ characterized in
that said repeller and extraction electrodes are arranged with a sufficient gap not causing collision with said laser flux generated by the laser beam irradiation system and
that said repeller and extraction electrodes have sufficient confronting surfaces which do not warp an electric field generated between said electrodes.

Claim 17 (currently amended): ~~A~~ The mass spectrometer as claimed in ~~any of claims 1, 2 and 4~~ claim 1 characterized in
that said mass analyzing means is reflectron type flight mass analyzing device.

Claim 18 (currently amended): ~~A~~ The mass spectrometer as claimed in claim 1 characterized in
that laser beam irradiation positioning means is further provided for determination of laser beam irradiation position to said carrier gas by said laser beam irradiation system prior to analysis of said carrier gas containing said sample molecules,
that said laser beam irradiation positioning means includes pressure measuring means and displaying means,
that said pressure measuring means measures pressure at a cross point of said carrier gas flow ejected by said pulsed gas ejecting means into said vacuum vessel with laser beam irradiated from said laser beam irradiation system,
that said displaying means displays a pressure time waveform of said carrier gas flow detected by said pressure measuring means,
that said pulsed gas ejecting means is able to change its distance with respect to said cross point of said carrier gas flow irradiation to said laser beam within said vacuum vessel and
that said pressure time waveform of said carrier gas can be confirmed by said displaying means as a position whereat said flat-top trapezoidal pressure distribution having a flat portion

transitions into said triangular pressure distribution without said flat portion.

Claim 19 (original): A laser beam irradiation positioning method to a carrier gas flow prior to mass analysis on a laser ionization mass spectrometer which includes pulsed gas ejecting means, a laser beam irradiation system, repeller and extraction electrodes and mass analyzing means, said pulsed gas ejecting means having a valve for ejecting in pulse mode said carrier gas containing sample molecules into a vacuum chamber, said laser beam irradiation system irradiating laser beam to said carrier gas containing said sample molecules and ejected into said vacuum chamber for selective photo reaction of said sample molecules in said carrier gas ejected into said vacuum chamber, said electrodes being arranged within said vacuum chamber and generating an electric field for extraction of said sample molecular ions generated by said photo reaction and said mass analyzing means analyzing mass of said sample molecular ions extracted by said electrodes
characterized in
that an overtaking position whereat a leading portion gas in said pulsed carrier gas ejected from said pulsed gas ejecting means and translating in said vacuum chamber, i.e. a gas ejected prior to full opening of said valve is overtaken by a faster flat portion gas, i.e. a gas ejected during full opening of said valve is obtained and
that said laser beam irradiation point to said carrier gas flow is set near said over-taking position.